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USER MANUAL

Starter Kit EFM32-G8XX-STK

Feature rich starter kit for evaluation, prototyping and application development for the EFM32 Gecko MCU family with the ARM Cortex-M3 CPU core.

Main features;

- **Advanced Energy Monitoring provides real-time visibility into the energy consumption of an application or prototype design.**
- **On-board debugger with debug out functionality**
- **160-segment Energy Micro LCD**

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1 Introduction

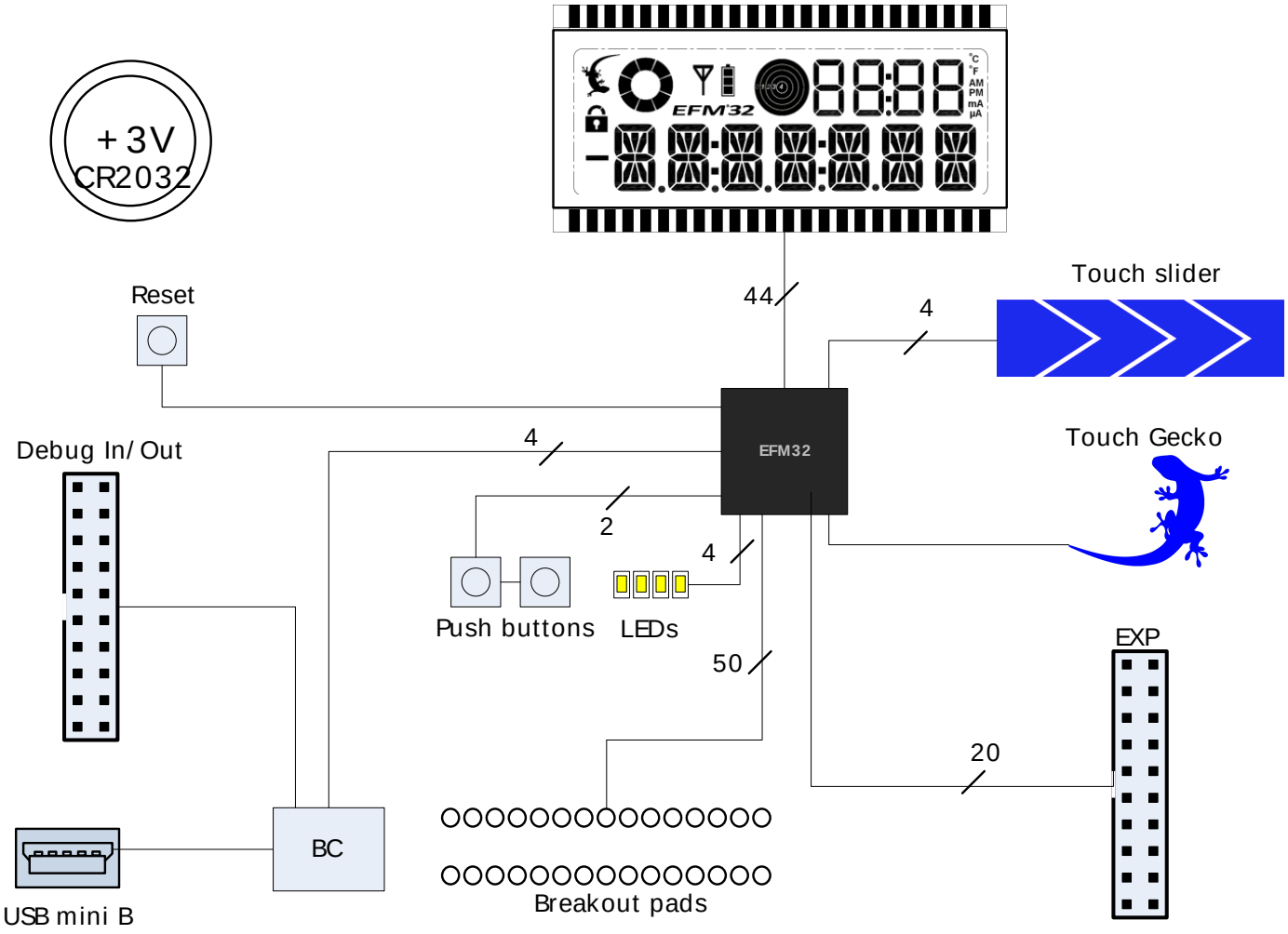
1.1 Features

- Advanced Energy Monitoring system for precise current tracking.
- Special hardware configuration for isolation of the MCU power domain.
- Full feature USB debugger with debug out functionality.
- 160 segment Energy Micro LCD.
- 20 pin expansion header.
- Breakout pads for easy access to I/O pins.
- Powered by USB or CR2032 battery.
- 2 user buttons, 4 user LEDs and touch slider.
- 32MHz and 32.768kHz crystal oscillators.

2 STK block diagram

An overview of the Kit is shown in the block diagram below.

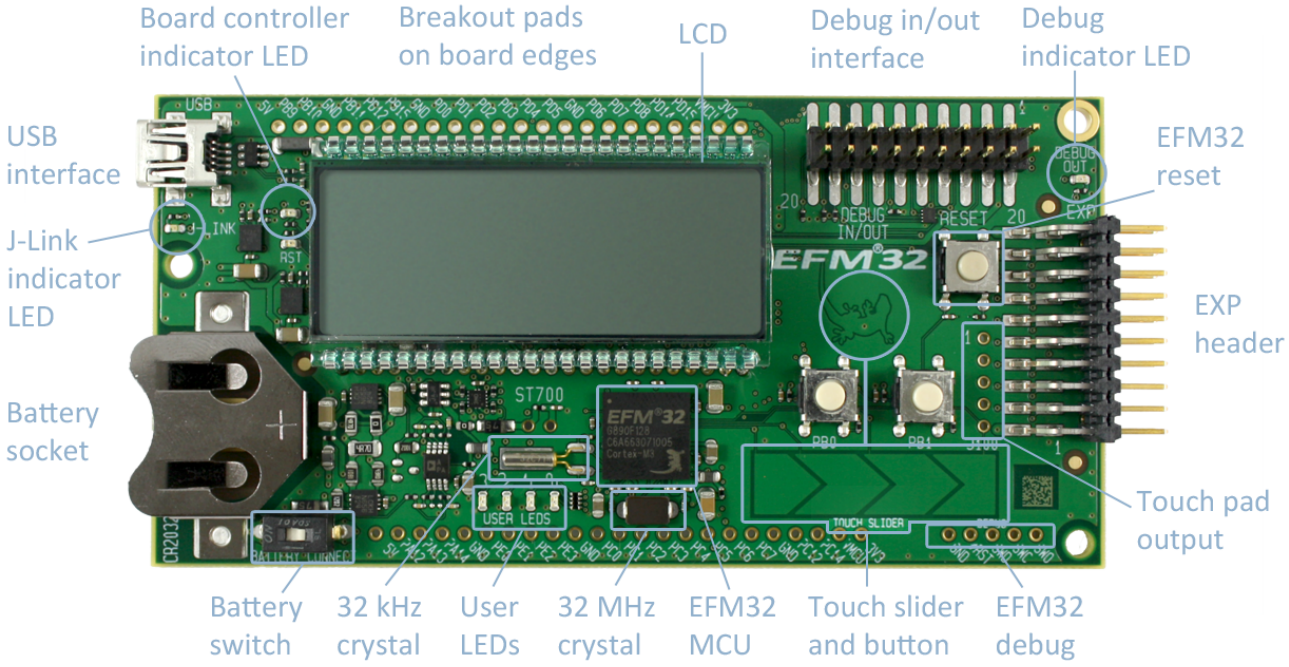
Figure 2.1. EFM32-G8XX-STK Block Diagram



3 Hardware layout

The layout of the EFM32-G8XX-STK is shown below.

Figure 3.1. EFM32-G8XX-STK hardware layout



4 Power supply

4.1 USB

The EFM32-G8XX-STK can get its power from the standard USB mini port. The MCU voltage will be 3.15 volts when USB is connected.

4.2 Battery

There is a socket for a 20mm coin cell battery, which can be used to power the kit. When the USB is disconnected and the battery connect switch is turned on, the EFM and its peripherals is powered by the battery. The VMCU voltage is 2.85 or lower when powered by the battery, depending on the battery voltage. There is a 0.15V drop down from the battery voltage. The board controller/AEM is not powered by the battery, so the BSP software support library cannot be used on battery power.

5 Reset infrastructure

5.1 MCU

The primary user reset for the MCU is the reset button on the MCU board. This will only reset the MCU. The MCU can also be reset by debuggers.

5.2 Board controller

The board controller can only be reset by pulling and reinserting the USB cable.

6 Peripherals

The starter kit has a set of peripherals that showcase some of the features of the EFM32G.

Be aware that most EFM I/O routed to peripherals are also routed to the breakout pads. This must be taken into consideration when using the breakout pads for your application.

6.1 Pushbuttons

The kit has two user pushbuttons marked PB0 and PB1. They are connected to the EFM, and are debounced by RC filters with a time constant of 1ms.

6.2 LEDs

There are four LEDs on the kit marked LED0 to LED3. An active high on the respective pins will light the LEDs.

6.3 LCD

An Energy Micro LCD display is connected to the EFM. These lines are not shared on the breakout pads. Capacitors for the EFM32G LCD boost function is available on the EFM32-G8XX-STK.

6.4 Touch slider

A touch slider utilizing the capacitive touch capability is available. It is placed under the two push buttons on the kit, above the "TOUCH SLIDER" print.

6.5 Touch Gecko

The Gecko above the pushbuttons, and below the EFM32 logo, can also be used as a capacitive touch button.

7 Advanced Energy Monitor

7.1 Usage

The AEM data is collected by the board controller and can be displayed by a PC application. For instance, the "Gecko commander" utility contains a "power" command which can dump power data to file. A GUI application for displaying power usage will be available for download from the Energy Micro download section later.

7.2 AEM theory of operation

In order to be able to measure currents ranging from 0.1uA to 50mA (114dB dynamic range), two current sense amplifiers are utilized. The amplifiers measure voltage drop over a small series resistor and translates this into a current. Each amplifier is adjusted for current measurement in a specific range. The ranges for the amplifiers overlap and a change between the two occurs when the current is 200uA. To reduce noise, averaging of the samples is performed before the current measurement is presented in the AEM GUI.

During startup of the kit, a calibration of the AEM is performed. This calibration compensates for the offset error in the sense amplifiers.

7.3 AEM accuracy and performance

The Advanced Energy Monitor is capable of measuring currents in the range of 0.1uA to 50mA. For currents above 200uA, the AEM is accurate within 0.1mA. When measuring currents below 200uA, the accuracy increases to 1uA. Even though the absolute accuracy is 1uA in the sub 200uA range, the AEM is able to detect changes in the current consumption as small as 100nA The measurement bandwidth of the AEM is 60Hz when measuring currents below 200uA and 120Hz when measuring currents above 200uA. The table below summarizes accuracy of the two current sense amplifiers in different ranges.

Table 7.1. AEM accuracy

Current range	Low gain amplifier accuracy	High gain amplifier accuracy
50mA	0.1mA	-
1mA	0.1mA	-
200uA	0.01mA	1uA
10uA	-	0.1uA
1uA	-	0.1uA

Note

Having both USB and battery connected may increase the AEM readings.

8 Board controller

The control MCU can act as a board controller (BC). There is a UART connection between the EFM and the BC. The connection is made by setting the bc_en line high. The EFM can then use the BSP to send commands to the BC. When bc_en is low, bc_tx and bc_rx can be used by other applications.

To use the board controller for your application, the Board Support Package (BSP) must be installed. See the BSP chapter to find out how.

Note

The board controller is only available when the STK is powered by USB.

9 Board Support Package

The Board Support Package (BSP) is a set of C source and header files that enables easy access to, and control over some board specific features.

Compared to the Energy Micro development kit, the functionality is limited. Unless you need/want some of the functions contained in the BSP, there is really no need to include or use it. The EFM32 in the Starter Kit can be fully usable without BSP support, and you can use all peripherals in the

```
C:\Program Files\Energy Micro\EFM32 Gecko DK\boards\EFM32_Gxxx_STK\drivers
```

folder without the BSP.

The BSP use EFM32 peripheral UART0 (TX pin PE0, RX pin PE1) on baudrate 115200-8-N-1 to communicate with the board controller.

Note

The BSP is only functional when the Starter Kit is USB-powered, using these function calls under battery power will give unpredictable results.

9.1 Installation location

When installing the complete software package for the kit, the BSP will be installed under the main installation directory, typically in a location such as

```
C:\Program Files\Energy Micro\EFM32 Gecko DK\boards\EFM32_Gxxx_STK\bsp\
```

or something similar (depending on your OS/Windows version). All files in the board support package is prefixed by stk.

9.2 Application Programming Interface

To use the BSP, include the Starter Kit header file, like this:

```
#include "stk.h"
```

All functions in the BSP are prefixed with STK_. The main initialization routine is defined as

```
void STK_Init(void);
```

and must be called before any access to the STK-functions. This function call will setup the UART communication channel with a 115800 baud rate. This baud rate depends on the current core clock, so correct clock configuration should be set before calling this function.

```
bool STK_Ready(void);
```

Returns *true* if the board controller is responding. A non-responding board will either return false, or hang (i.e. if the EFM32 is powered by the CR2032 battery cell).

```
float STK_Current(void);
```

Returns instant current usage in milliamperes.

```
float STK_Voltage(void);
```

Returns instant voltage (VMCU) reading in volt.

```
bool STK_EnergyMode(uint8_t em);
```

Informs the board controller about the Energy Mode (sleep mode) we are going into. This information can be used by the board controller to present a richer visual graph for illustrating what the EFM32 is currently doing.

In addition to these main functions, full documentation of the complete API is included in the Doxygen/HTML documentation of the installed package.

9.3 Example Applications

Under the EFM32_Gxxx_STK/examples folder in your installation directory, you will find an example program using the BSP, with corresponding project/Makefiles for the supported IDEs.

9.4 How to include in your own applications

The easiest way to include the BSP in your application is to base your work on the example application that use the BSP. The following items are recommended for correct configuration:

1. Make sure you define the correct part number (i.e. EFM32G890F128) as a preprocessor defined symbol
2. Make sure you define the correct part number (i.e. EFM32G890F128) for your project file
3. Add and include the EFM32_CMSIS-files (startup_efm32.s, system_efm32.c, core_cm3.c) to your project
4. Add and include _all_ BSP package .c-files, with the stk-prefix to your project
5. Configure include paths to point at the CMSIS/CM3/CoreSupport and CMSIS/CM3/DeviceSupport/EnergyMicro/EFM32 directories
6. Configure include paths to point to the EFM32_Gxxx_STK/bsp directory

Make sure you call "STK_Init()" early at startup, and you should be all set.

9.5 Chip errata

Early versions of the development kit are shipped with EFM32 Engineering Samples on the MCU modules. There has been updates to configuration and reset values that needs to be configured correctly on these early parts. We recommend always starting your application with a call to

```
#include "efm32_chip.h"

CHIP_Init();
```

in the EFM32_CMSIS (version 1.3.0 or later) core package to ensure correct and stable behavior. See the BSP examples for details. We recommend also to download and read the latest errata from the Energy Micro website for your part number.

10 Connectors

10.1 Breakout pads

Most I/O except the LCD pins are routed to the breakout pads at the top and bottom edge of the kit. A 2.54mm (100 mil) pitch pin header can be soldered in place on the pads for easier access.

Note

Some of the breakout pads are shared by on-board EFM peripherals. The shared pins can be identified by looking at the Shared by column in the tables below. The schematic must be consulted to make sure that it is OK to use a shared pin in your application.

Table 10.1. Bottom breakout pad row

Pin	Alternative Functions	Shared by
5V	-	-
PA12	TIM2_CC0	LCD Boost capacitor
PA13	TIM2_CC1	LCD Boost capacitor
PA14	TIM2_CC2	LCD Boost capacitor
GND	-	-
PE0	U0_TX/PCNT0_S0	BC_TX
PE1	U0_RX/PCNT0_S1	BC_RX
PE2	ACMP0_O	EXP header
PE3	ACMP1_O	-
GND	-	-
PC0	ACMP0_CH0/US1_TX/PCNT0_S0	User LED 0
PC1	ACMP0_CH1/US1_RX/PCNT0_S1	User LED 1
PC2	ACMP0_CH2/US2_TX	User LED 2
PC3	ACMP0_CH3/US2_RX	User LED 3
PC4	ACMP0_CH4/LET0_O0/US2_CLK/PCNT1_S0	EXP header
PC5	ACMP0_CH5/LET0_O1/US2_CS/PCNT1_S1	EXP header
PC6	ACMP0_CH6/LEU1_TX/I2C0_SDA	-
PC7	ACMP0_CH7/LEU1_RX/I2C0_SCL	-
PC8	ACMP1_CH0/TIM2_CC0/US0_CS	Touch slider segment 0
PC9	ACMP1_CH1/TIM2_CC1/US0_CLK	Touch slider segment 1
PC10	ACMP1_CH2/TIM2_CC2/US0_RX	Touch slider segment 2
PC11	ACMP1_CH3/US0_TX	Touch slider segment 3
PC12	ACMP1_CH4/CMU_OUT0	EXP header
PC13	ACMP1_CH5/TIM1_CC0/TIM0_CDTI0/PCNT0_S0	Touch Gecko
PC14	ACMP1_CH6/TIM1_CC1/TIM0_CDTI1/PCNT0_S1	-
VMCU	-	-
3V3	-	-

Table 10.2. Top breakout pad row

Pin	Alternative Functions	Shared by
5V	-	-
PB9	-	User button 0
PB10	-	User button 1
GND	-	-
PB11	DAC_OUT0/LET0_O0	EXP header
PB12	DAC_OUT1/LET0_O1	EXP header
PB15	-	-
GND	-	-
PD0	US1_TX/PCNT2_S0	EXP header
PD1	TIM0_CC0/US1_RX/PCNT2_S1	EXP header
PD2	TIM0_CC1/US1_CLK	EXP header
PD3	TIM0_CC2/US1_CS	EXP header
PD4	LEU0_TX	EXP header
PD5	LEU0_RX	EXP header
GND	-	-
PD6	ACMP0_CH6/LET0_O0/I2C0_SDA	EXP header
PD7	ACMP0_CH7/LET0_O1/I2C0_SCL	EXP header
PD8	ADC0_VCM/CMU_OUT1	EXP header
PD14	I2C0_SDA	-
PD15	I2C0_SCL	-
VMCU	-	-
3V3	-	-

10.2 Expansion header

A 20 pin expansion header can be used to connect plugin boards. This contains a selection of I/O plus powers and ground. See the pinout in the table below.

Table 10.3. Expansion header pinout

I/O	#	#	I/O
GND	1	2	VMCU
PC4	3	4	PD0
PC5	5	6	PD1
PC12	7	8	PD2
PE2	9	10	PD3
PB11	11	12	PD4
PB12	13	14	PD5
PD7	15	16	PD6
PD8	17	18	5V
GND	19	20	3V3

Table 10.4. Expansion header pin list

EXP header pin number	MCU GPIO pin	MCU GPIO pin functions
1	GND	Ground
2	VMCU	MCU supply voltage
3	PC4	USART2_CLK #0 / LETIMER_OUT0 #3 / PCNT1_S0IN #0 / ACMP0_CH4
4	PD0	USART1_TX #1 / PCNT2_S0IN #0 / ADC0_CH0
5	PC5	USART2_CS #0 / LETIMER_OUT1 #3 / PCNT1_S1IN #0 / ACMP0_CH5
6	PD1	TIMER0_CC0 #3 / USART1_RX #1 / PCNT2_S1IN #0 / ADC0_CH1
7	PC12	CMU_CLKOUT0 #1 / ACMP1_CH4
8	PD2	TIMER0_CC1 #3 / USART1_CLK #1 / ADC0_CH2
9	PE2	ACMP0 _OUT #1
10	PD3	TIMER0_CC2 #3 / USART1_CS #1 / ADC0_CH3
11	PB11	LETIMER0_OUT0 #1 / DAC0_OUT0
12	PD4	LEUART0_TX #0 / ADC0_CH4
13	PB12	LETIMER0_OUT1 #1 / DAC0_OUT1
14	PD5	LEUART0_RX #0 / ADC0_CH5
15	PD7	LETIMER0_OUT1 #0 / I2C0_SCL #1 / ADC0_CH7
16	PD6	LETIMER0_OUT0 #0 / I2C0_SDA #1 / ADC0_CH6
17	PD8	CMU_CLKOUT1 #1 / ADC0_VCM
18	5V	USB Power
19	GND	Ground
20	3V3	3.3V board power

10.3 Debug connector

This connector is used for Debug In and Debug Out (see Debug chapter). The pinout is described in the table.

Table 10.5. Debug connector pinout

Pin number	Function	Note
1	VTARGET	Target voltage on the debugged application.
2	NC	
3	/TRST	JTAG tap reset
4	GND	
5	TDI	JTAG data in
6	GND	
7	TMS/SWDIO	JTAG TMS or Serial Wire data I/O
8	GND	
9	TCK	JTAG TCK or Serial Wire clock
10	GND	
11	RTCK	JTAG RTCK
12	GND	
13	TDO/SWO	JTAG TDO or Serial Wire Output
14	GND	
15	/RESET	Target MCU reset
16	GND	
17	PD	This pin has a 100k pulldown.
18	Cable detect	This signal must be pulled to ground by the external debugger or application for cable insertion detection.
19	PD	This pin has a 100k pulldown.
20	GND	

11 Debugging

The EFM32-G8XX-STK has an on-board debugger, and it can be used in different ways to debug the EFM, both on and off kit. Below are descriptions on the different modes. Check the configuration chapter to find out how to change the debug setting.

Table 11.1. Debug modes

Mode	Description
Debug MCU	In this mode the on-board debugger is connected to EFM on the EFM32-G8XX-STK.
Debug IN	In this mode the on-board debugger is disconnected, and an external debugger can be connected to debug the EFM on the EFM32-G8XX-STK.
Debug OUT	In this mode the on-board debugger can be used to debug an EFM mounted in your own application.

11.1 Debugging during battery operation

When the EFM is powered by the battery (i.e. the USB is disconnected), the on-board debug functionality is not available. To enable debugging in this mode, connect an external debugger (e.g. another EFM32-G8XX-STK) to the debug pads in the bottom right corner of the EFM32-G8XX-STK. These pads are connected directly to the EFM32 debug interface.

Note

When the on-board debugger is active, a current of approximately 1.6uA will be added to the AEM measurements.

12 Integrated Development Environments

The Energy Micro software packages contains various examples in source form to use with the Starter Kit. The following IDEs are supported.

12.1 IAR Embedded Workbench for ARM

An evaluation version of IAR Embedded Workbench for ARM is included on a CD in the EFM32-G8XX-STK package. Check the quick start guide for where to find updates, and IAR's own documentation on how to use it. You will find the IAR project file in the

```
iar
```

subfolder of each project

12.2 Rowley Associates - CrossWorks for ARM

See the quick start guide for download details for CrossWorks for ARM. You will find CrossWorks project files in the

```
rowley
```

subfolder of each project.

12.3 CodeSourcery - Sourcery G++

See the quick start guide for download details for Sourcery G++. The

```
codesourcery
```

subfolder contains Makefiles for use with the Sourcery G++ development environment.

12.4 Keil - MDK-ARM

See the quick start guide for download details for evaluation versions of Keil MDK-ARM. The

```
arm
```

subfolder in each project contains project files for MDK-ARM. Please see the MDK-ARM documentation for usage details.

13 energyAware Commander and Upgrades

energyAware Commander is a program that comes with the Gecko DK Installer package. It can perform various kit and EFM32 specific tasks. The program has two modes of operation, either *command line* or *GUI mode*. The command line is not backwards compatible with the earlier "Gecko Commander" shell utility, but support all features of that package.

13.1 GUI Operation

The primary use of *energyAware Commander* is in the GUI mode. This utility gives the ability to program the EFM32, upgrade the kit, lock and unlock devices and more. Some of the features will only work with Energy Micro kits, while other will work with a J-Link debugger connected. Press the "F1" button, or select the "Help->Help" menu item for a full description.

13.2 Command Line operation

Using the command line involves runnig the binary in a command shell, with an appropriate argument, e.g.

```
eACommander.exe --help
```

All command line options will be parsed in the other they are given, so multiple commands can be run.

Table 13.1. energyAware Commander command line options

Option	Description
--version	Prints version and exits
--help (-h)	Prints this help information
--flash image.bin (-f)	Flash binary file to EFM32
--install package.emz (-i)	Install kit firmware
--mcuinfo	Print MCU information
--kitinfo	Print Kit information
--usb 0-3 (-u)	Specify USB address
--speed wanted speed (-s)	Set SWD speed (in kHz)
--verify (-v)	Verify flash after upload
--mode in|out|mcu|off (-m)	Set debug mode
--unlock	Unlock a locked chip
--lock (-l)	Lock a chip
--reset (-r)	Reset the EFM32
--unprotect	Unprotect pages
--protect start stop	Protect pages
--upload file	Upload files to DVK
The mode option argument	Sets the mode of the on-board debugger. Available modes: *mcu* - Debug the EFM32 using the on-board debugger *in* - Debug the EFM32 using an external debugger *out* - Use the STK as an external debugger *off* - Disable the debugger

13.3 Upgrades

Upgrading the kit can be done by using the "Upgrade Kit" script in the start menu. New versions can be downloaded from http://www.energymicro.com/downloads/. The script will use *energyAware Commander* to install the latest available Kit SW package. It is important to upgrade the kit when installing a new SW package, as new *energyAware Commander* functionality might require kit controller software upgrades.

You can also use the *energyAware Commander* for upgrades. Select the "Kit" icon, use the "Browse" button to select the correct file ending in ".emz", and press the "Install package button".

Finally, there is an option at the command line,

```
eACommander.exe --install stkappl.emz
```

to explictly install new packages by hand (or within a script).

14 Errata

The following sections lists the erratas and known issues for operating the STK. You can read the STK revision on the white label on the back side of the STK. It is in the format "BRD2001, Rev: Axx".

14.1 Chip errata

You can use *energyAware Commander* (GUI version) and press the "Connect" button to retrieve EFM32 revision information. You can also use the command line version:

```
eACommander.exe --mcuinfo
```

for the same. Download the chip errata from http://www.energymicro.com for the latest erra updates on your device.

14.2 efm32lib Chip Init routine

The efm32lib

```
#include "efm32_chip.h"
CHIP_Init()
```

routine will, as far as possible, enable work arounds for chip erratas to make EFM32 Gecko devices be as software compatible as possible. In some cases, this can introduce increased current. See the device errata and source code for details.

14.3 STK Revision Errata

Table 14.1. BRD2001 Revision Errata

Revision	Problem	Description
A00-A05	Increased current usage	The Gecko series of devices has an errata, where going to Energy Mode 2 will drive a pull down on the SWO (Serial Wire Output) UART serial line. This will increase current with 80-100 uA. Work around is not using SWO to get more accurate measurements.

15 Version information

The current version information can be read from Gecko Commander.

Table 15.1. Current versions

Type	Version	Released
Firmware revision	1v3p0	2010-11-15
Board	BRD2001A Rev. A04	2010-04-09
Board	BRD2001A Rev. A05	2010-09-06

16 Schematic

On the next pages you can find the schematic and the assembly drawings of the main board.

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Revision History

Rev.	Description
A00	A lot of bug fixes and improvements.
A01	Added #RST to the debug header and added a separate header (J100) for the touch segment pins.
A02	Fixed renaming of 3V3 to PCB_REV0
A03	Swapped two pins on D600 to simplify routing.

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	Schematic Title: **EFM32 Starter Kit**
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Designed: GB / Approved: <OrgAddr2>	
Size: A3 / BOM Doc No: <Cage Code>	Document number: **BRD2001A** / Revision: A03
Design Created Date: Wednesday, December 03, 2008	Sheet Created Date: Saturday, March 21, 2009 / Sheet Modified Date: Tuesday, June 29, 2010 / Sheet: 1 of 10

TODO: Hide TP values before release

(p 4,6) MCU_PA[15..0]
MCU_PA12 TP100
MCU_PA13 TP101
MCU_PA14 TP102

(p 5,6) MCU_PB[15..0]
MCU_PB9 TP146
MCU_PB10 TP145
MCU_PB11 TP103
MCU_PB12 TP104
TP148
MCU_PB15

(p 3,4,9) MCU_PC[15..0]
MCU_PC0 TP105
MCU_PC1 TP106
MCU_PC2 TP107
MCU_PC3 TP108
MCU_PC4 TP109
MCU_PC5 TP110
MCU_PC6 TP111
MCU_PC7 TP112
MCU_PC8 → J100 pin 1
MCU_PC9 → J100 pin 2
MCU_PC10 → J100 pin 3
MCU_PC11 → J100 pin 4
MCU_PC12 → J100 pin 5
MCU_PC13 TP115
MCU_PC14 TP117

J100: 1 2 3 4 5 NM

(p 4,6) MCU_PD[15..0]
MCU_PD0 TP118
MCU_PD1 TP119
MCU_PD2 TP120
MCU_PD3 TP121
MCU_PD4 TP122
MCU_PD5 TP123
MCU_PD6 TP124
MCU_PD7 TP125
MCU_PD8 TP126
MCU_PD14 TP127
MCU_PD15 TP128

(p 4,6) MCU_PE[15..0]
MCU_PE0 TP129
MCU_PE1 TP130
MCU_PE2 TP131
MCU_PE3 TP132

TP133 TP134 TP135 TP136 TP137 TP138 → GND

VMCU → TP139 TP140

3V3 → TP141 TP142

5V → TP143 TP144

User pushbuttons

(p 4) UIF_PB[1..0] → UIF_PB[1..0]
UIF_PB0
UIF_PB1

VMCU
R101 100K
R102 100K
C100 10N
C101 10N
SW100 R100 100R
SW101 R103 100R
GND

Touch slider

T100 TOUCH SLIDER
(p 4) UIF_SLIDER[3..0]
UIF_SLIDER0
UIF_SLIDER1
UIF_SLIDER2
UIF_SLIDER3

Touch gecko

T101 TOUCH GECKO
UIF_GECKO

EXP port

VMCU 5V 3V3
P100
(p 3,4,9) MCU_PC[15..0]
MCU_PC4
MCU_PC5
MCU_PC12
MCU_PE2
MCU_PB11
MCU_PB12
MCU_PD7
MCU_PD8
(p 4) MCU_PE2
(p 4) MCU_PB11
(p 4) MCU_PB12
MCU_PD0
MCU_PD1
MCU_PD2
MCU_PD3
MCU_PD4
MCU_PD5
MCU_PD6
HEADER_2X10_2.54MM_HOR_SMD
GND
MCU_PD[15..0] (p 4,6)

User LEDs

(p 4) UIF_LED[3..0]
RP100 2K2
UIF_LED0
UIF_LED1
UIF_LED2
UIF_LED3
LED100 YELLOW
LED101 YELLOW
LED102 YELLOW
LED103 YELLOW
GND

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Schematic Title	**EFM32 Starter Kit**
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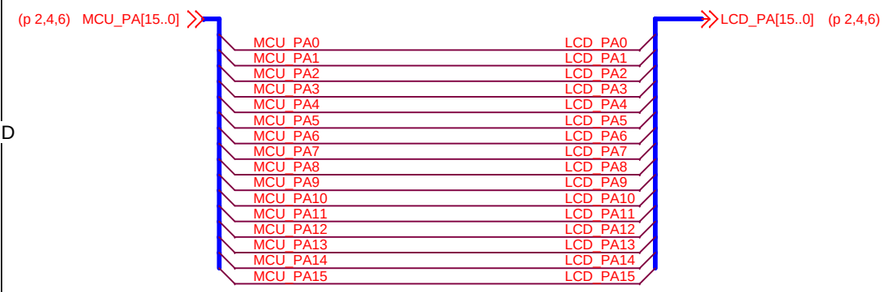
5 4 3 2 1

D

PA Connections



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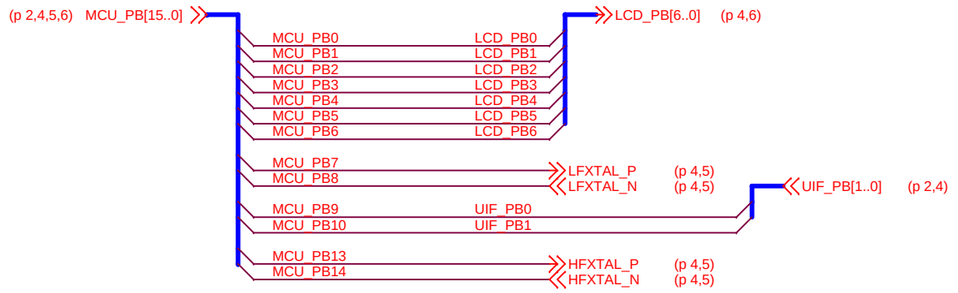
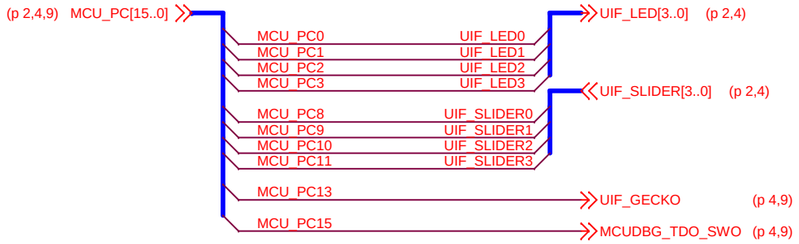


PC Connections

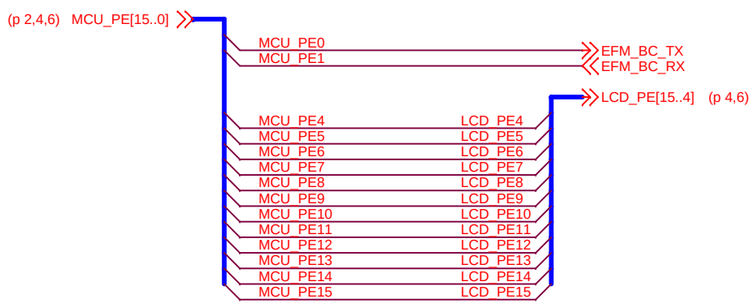
C



PD Connections

B

PE Connections



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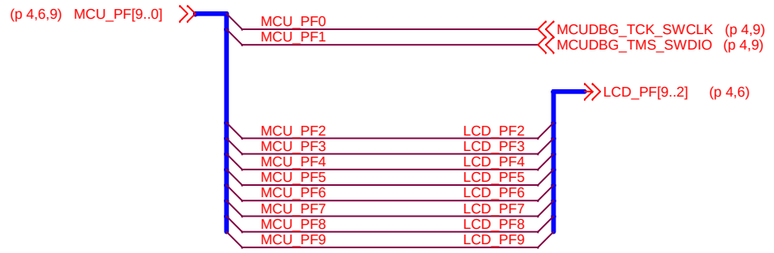

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(p 2,6) MCU_PA[15..0]
(p 2,5,6) MCU_PB[15..0]
(p 2,3,9) MCU_PC[15..0]
(p 2,6) MCU_PD[15..0]
(p 2,6) MCU_PE[15..0]
(p 6,9) MCU_PF[9..0]

U300B

MCU_PD0	L11	D0 / USART1_TX #1 / PCNT2_S0IN #0 / ADC0_CH0
MCU_PD1	K11	D1 / TIMER0_CC0 #3 / USART1_RX #1 / PCNT2_S1IN #0 / ADC0_CH1
MCU_PD2	J9	D2 / TIMER0_CC1 #3 / USART1_CLK #1 / ADC0_CH2
MCU_PD3	J10	D3 / TIMER0_CC2 #3 / USART1_CS #1 / ADC0_CH3
MCU_PD4	J11	D4 / LEUART0_TX #0 / ADC0_CH4
MCU_PD5	H9	D5 / LEUART0_RX #0 / ADC0_CH5
MCU_PD6	H10	D6 / LETIMER0_OUT0 #0 / I2C0_SDA #1 / ADC0_CH6
MCU_PD7	H11	D7 / LETIMER0_OUT1 #0 / I2C0_SCL #1 / ADC0_CH7
MCU_PD8	H8	D8 / CMU_CLKOUT1 #1 / ADC0_VCM
MCU_PD9	D6	D9 / EBI_CS0 / LCD_SEG28
MCU_PD10	A5	D10 / EBI_CS1 / LCD_SEG29
MCU_PD11	B5	D11 / EBI_CS2 / LCD_SEG30
MCU_PD12	C5	D12 / EBI_CS3 / LCD_SEG31
MCU_PD13	C4	D13
MCU_PD14	H3	D14 / I2C0_SDA #3
MCU_PD15	J3	D15 / I2C0_SCL #3
PORT D		
MCU_PE0	E9	E0 / UART0_TX #1 / PCNT0_S0IN #1
MCU_PE1	E10	E1 / UART0_RX #1 / PCNT0_S1IN #1
MCU_PE2	F10	E2 / ACMP0 _OUT #1
MCU_PE3	E11	E3 / ACMP1_OUT #1
MCU_PE4	A9	E4 / USART0_CS #1 / LCD_COM0
MCU_PE5	B9	E5 / USART0_CLK #1 / LCD_COM1
MCU_PE6	C9	E6 / USART0_RX #1 / LCD_COM2
MCU_PE7	D9	E7 / USART0_TX #1 / LCD_COM3
MCU_PE8	B4	E8 / EBI_AD0 / PCNT2_S0IN #1 / LCD_SEG4
MCU_PE9	A4	E9 / EBI_AD1 / PCNT2_S1IN #1 / LCD_SEG5
MCU_PE10	C3	E10 / EBI_AD2 / TIMER1_CC0 #1 / USART0_TX #0 / LCD_SEG6
MCU_PE11	B3	E11 / EBI_AD3 / TIMER1_CC1 #1 / USART0_RX #0 / LCD_SEG7
MCU_PE12	A3	E12 / EBI_AD4 / TIMER1_CC2 #1 / USART0_CLK #0 / LCD_SEG8
MCU_PE13	B2	E13 / EBI_AD5 / USART0_CS #0 / ACMP0_OUT #0 / LCD_SEG9
MCU_PE14	A2	E14 / EBI_AD6 / LEUART0_TX #2 / LCD_SEG10
MCU_PE15	A1	E15 / EBI_AD7 / LEUART0_RX #2 / LCD_SEG11
PORT E		
MCU_PF0	E8	F0 / LETIMER0_OUT0 #2 / DBG_SWCLKTCK
MCU_PF1	D8	F1 / LETIMER0_OUT1 #2 / DBG_SWDITMS
MCU_PF2	C8	F2 / EBI_ARDY / ACMP1_OUT #0 / DBG_SWV #0 / LCD_SEG0
MCU_PF3	B8	F3 / TIMER0_CCC0 #2 / EBI_ALE / LCD_SEG1
MCU_PF4	A8	F4 / TIMER0_CCC1 #2 / EBI_WEn / LCD_SEG2
MCU_PF5	A7	F5 / TIMER0_CCC2 #2 / EBI_REn / LCD_SEG3
MCU_PF6	B7	F6 / TIMER0_CC0 #2 / UART0_TX #0 / LCD_SEG24
MCU_PF7	A6	F7 / TIMER0_CC1 #2 / UART0_RX #0 / LCD_SEG25
MCU_PF8	B6	F8 / TIMER0_CC2 #2 / LCD_SEG26
MCU_PF9	C6	F9 / LCD_SEG27
PORT F		

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U300A

MCU_PA0	C2	A0 / TIMER0_CC0 #0,1 / EBI_AD9 / I2C0_SDA #0 / LCD_SEG13
MCU_PA1	C1	A1 / TIMER0_CC1 #0,1 / CMU_CLKOUT1 / EBI_AD10 / I2C0_SCL #0 / LCD_SEG14
MCU_PA2	D2	A2 / TIMER0_CC2 #0,1 / CMU_CLKOUT0 / EBI_AD11 / LCD_SEG15
MCU_PA3	D1	A3 / TIMER0_CCC0 #0 / EBI_AD12 / UART0_TX #2 / LCD_SEG16
MCU_PA4	E3	A4 / TIMER0_CCC1 #0 / EBI_AD13 / UART0_RX #2 / LCD_SEG17
MCU_PA5	E2	A5 / TIMER0_CCC2 #0 / EBI_AD14 / LEUART1_TX #1 / LCD_SEG18
MCU_PA6	E1	A6 / EBI_AD15 / LEUART1_RX #1 / LCD_SEG19
MCU_PA7	H4	A7 / LCD_SEG35
MCU_PA8	H5	A8 / TIMER2_CC0 #0 / LCD_SEG36
MCU_PA9	J5	A9 / TIMER2_CC1 #0 / LCD_SEG37
MCU_PA10	J6	A10 / TIMER2_CC2 #0 / LCD_SEG38
MCU_PA11	K5	A11 / LCD_SEG39
MCU_PA12	J4	A12 / TIMER2_CC0 #1 / LCD_BCAP_P
MCU_PA13	K3	A13 / TIMER2_CC1 #1 / LCD_BCAP_N
MCU_PA14	L3	A14 / TIMER2_CC2 #1 / LCD_BEXT
MCU_PA15	B1	A15 / EBI_AD8 / LCD_SEG12
PORT A		
MCU_PB0	E4	B0 / TIMER1_CC0 #2 / LCD_SEG32
MCU_PB1	F1	B1 / TIMER1_CC1 #2 / LCD_SEG33
MCU_PB2	F2	B2 / TIMER1_CC2 #2 / LCD_SEG34
MCU_PB3	F3	B3 / USART2_TX #1 / PCNT1_S0IN #1 / LCD_SEG20
MCU_PB4	F4	B4 / USART2_RX #1 / PCNT1_S1IN #1 / LCD_SEG21
MCU_PB5	G1	B5 / USART2_CLK #1 / LCD_SEG22
MCU_PB6	G2	B6 / USART2_CS #1 / LCD_SEG23
MCU_PB7	K1	B7 / USART1_CLK #0/ LFXTAL_P
MCU_PB8	L1	B8 / USART1_CS #0 / LFXTAL _N
MCU_PB9	J7	B9
MCU_PB10	J8	B10
MCU_PB11	L5	B11 / LETIMER0_OUT0 #1 / DAC0_OUT0
MCU_PB12	L6	B12 / LETIMER0_OUT1 #1 / DAC0_OUT1
MCU_PB13	L8	B13 / LEUART0_TX #1 / HFXTAL_P
MCU_PB14	L9	B14 / LEUART0_RX #1 / HFXTAL_N
MCU_PB15	D3	B15
PORT B		
MCU_PC0	H1	C0 / USART1_TX #0 / PCNT0_S0IN #2 / ACMP0_CH0
MCU_PC1	J1	C1 / USART1_RX #0 / PCNT0_S1IN #2 / ACMP0_CH1
MCU_PC2	H2	C2 / USART2_TX #0 / ACMP0_CH2
MCU_PC3	J2	C3 / USART2_RX #0 / ACMP0_CH3
MCU_PC4	K2	C4 / USART2_CLK #0 / LETIMER_OUT0 #3 / PCNT1_S0IN #0 / ACMP0_CH4
MCU_PC5	L2	C5 / USART2_CS #0 / LETIMER_OUT1 #3 / PCNT1_S1IN #0 / ACMP0_CH5
MCU_PC6	G10	C6 / LEUART1_TX #0 / I2C0_SDA #2 / ACMP0_CH6
MCU_PC7	G11	C7 / LEUART1_RX #0 / I2C0_SCL #2 / ACMP0_CH7
MCU_PC8	D10	C8 / TIMER2_CC0 #2 / USART0_CS #2 / ACMP1_CH0
MCU_PC9	D11	C9 / TIMER2_CC1 #2 / USART0_CLK #2 / ACMP1_CH1
MCU_PC10	C10	C10 / TIMER2_CC2 #2 / USART0_RX #2 / ACMP1_CH2
MCU_PC11	C11	C11 / USART0_TX #2 / ACMP1_CH3
MCU_PC12	B10	C12 / CMU_CLKOUT0 #1 / ACMP1_CH4
MCU_PC13	B11	C13 / TIMER0_CCC0 #1,3 / TIMER1_CC0 #0 / PCNT0_S0IN #0 / ACMP1_CH5
MCU_PC14	A10	C14 / TIMER0_CCC1 #1,3 / TIMER1_CC1 #0 / UART0_TX #3 / PCNT0_S1IN #0 / ACMP1_CH6
MCU_PC15	A11	C15 / TIMER0_CCC2 #1,3 / TIMER1_CC2 #0 / UART0_RX #3 / DBG_SWV #1 / ACMP1_CH7
PORT C		

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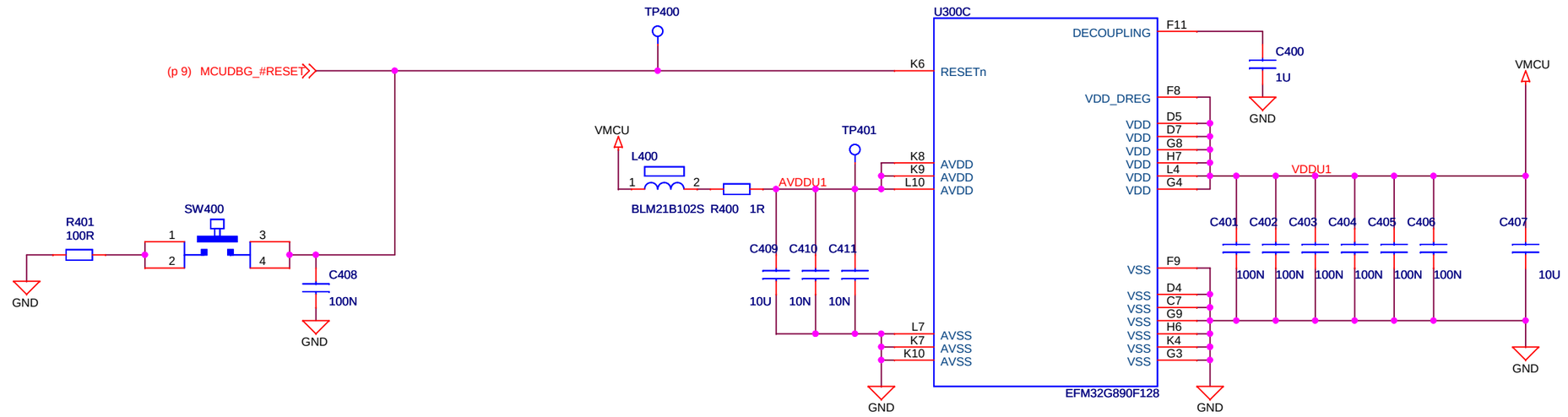

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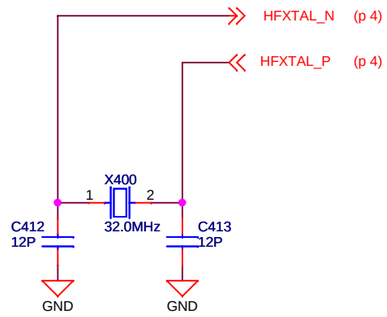

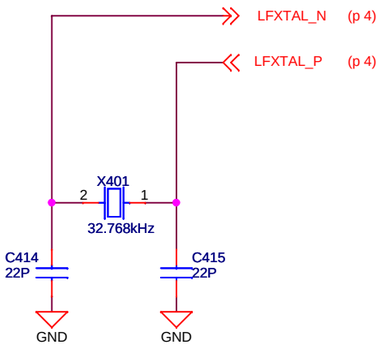

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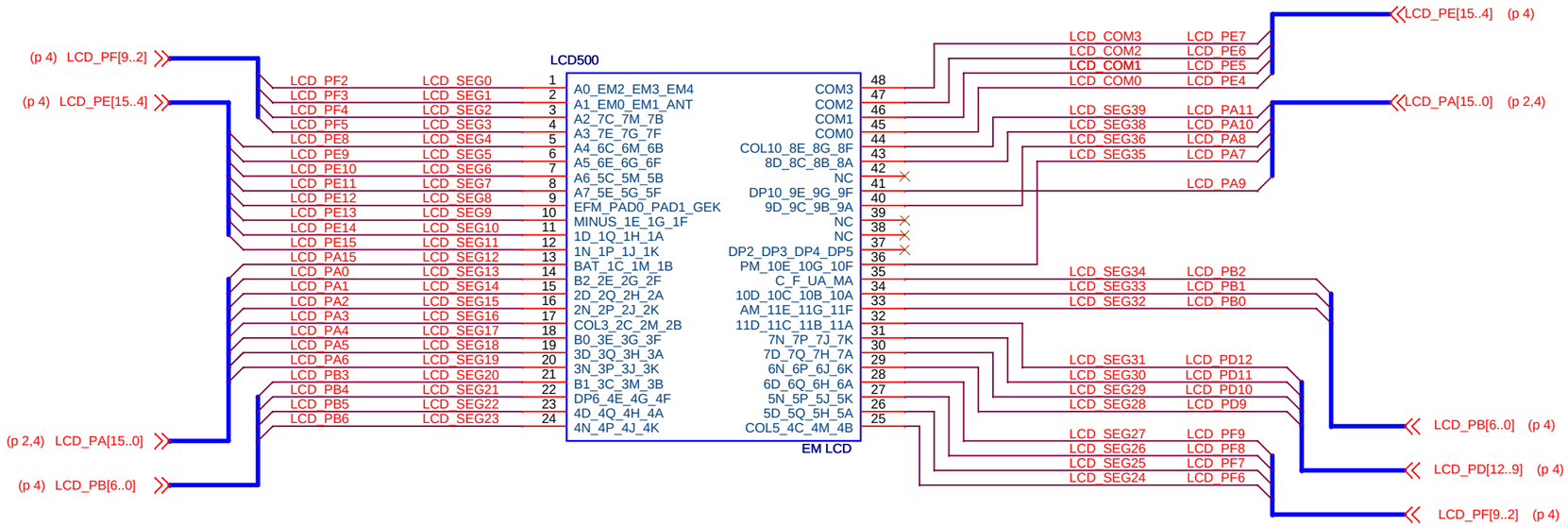
LCD signal connections



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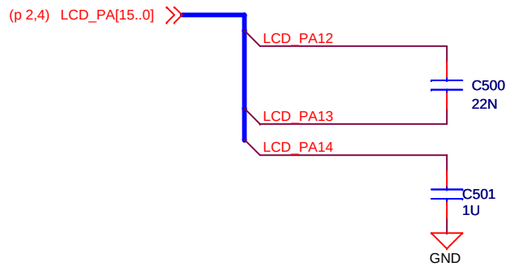
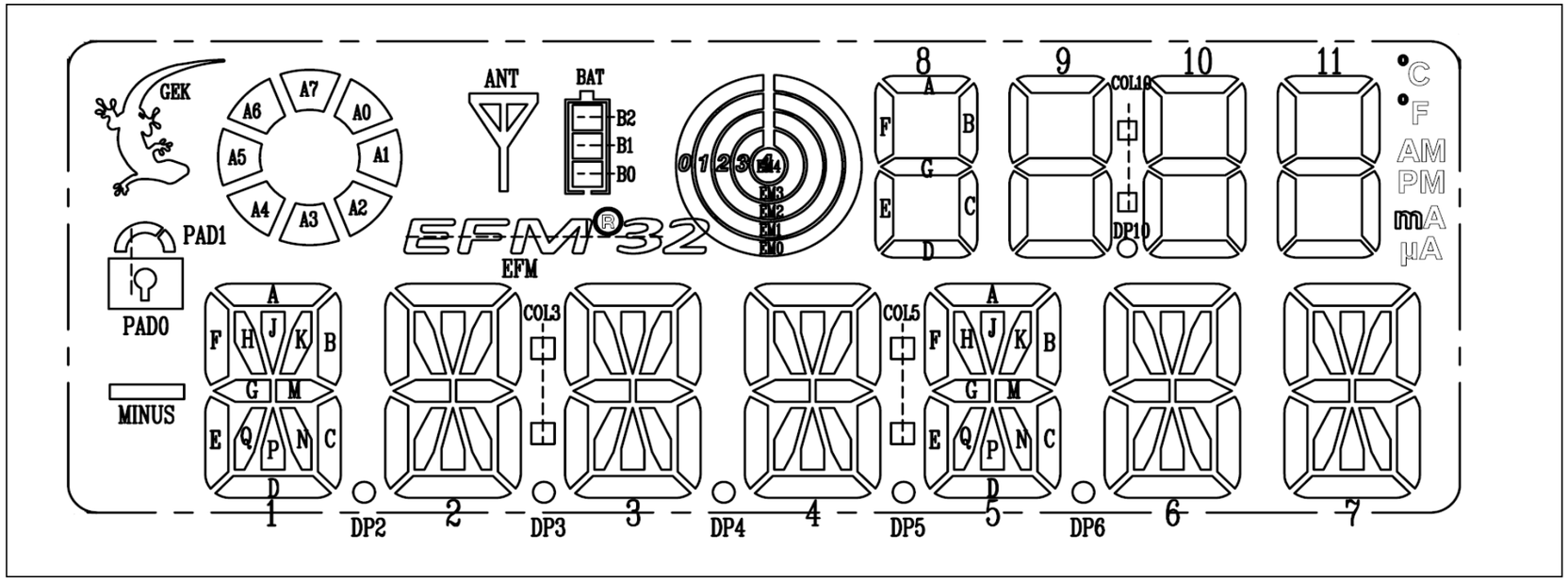


Segment names



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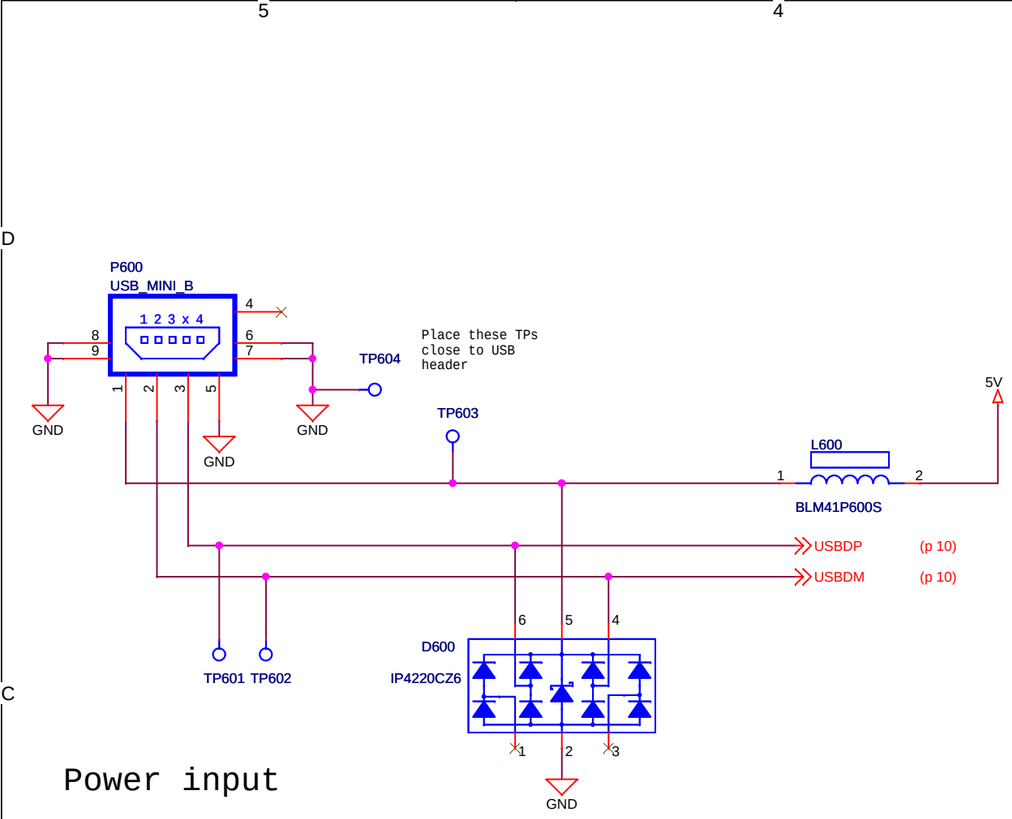

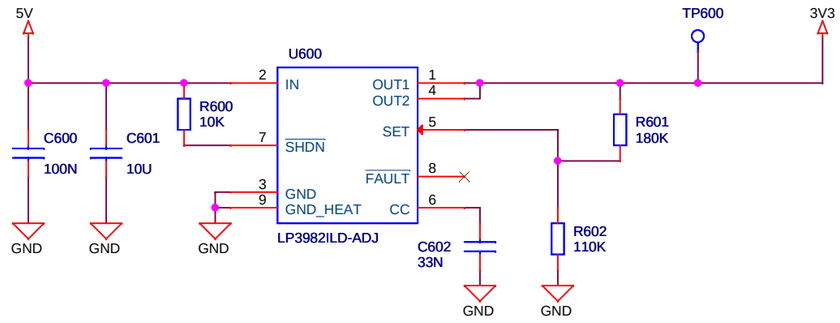

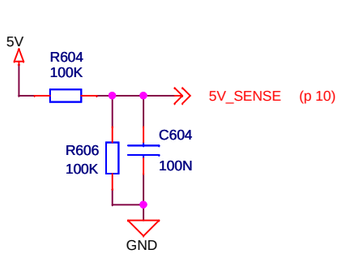

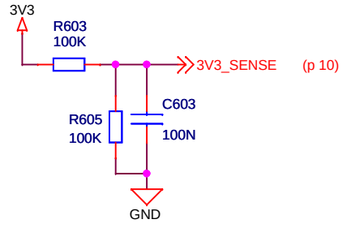

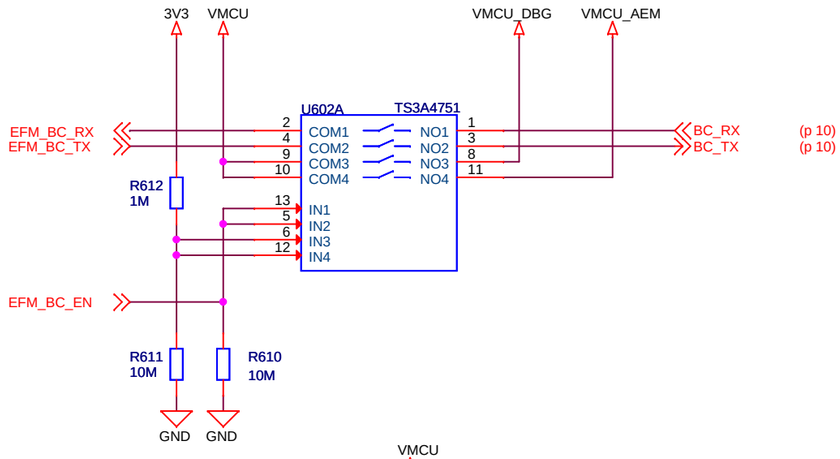

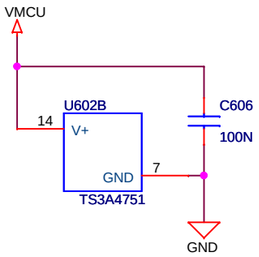

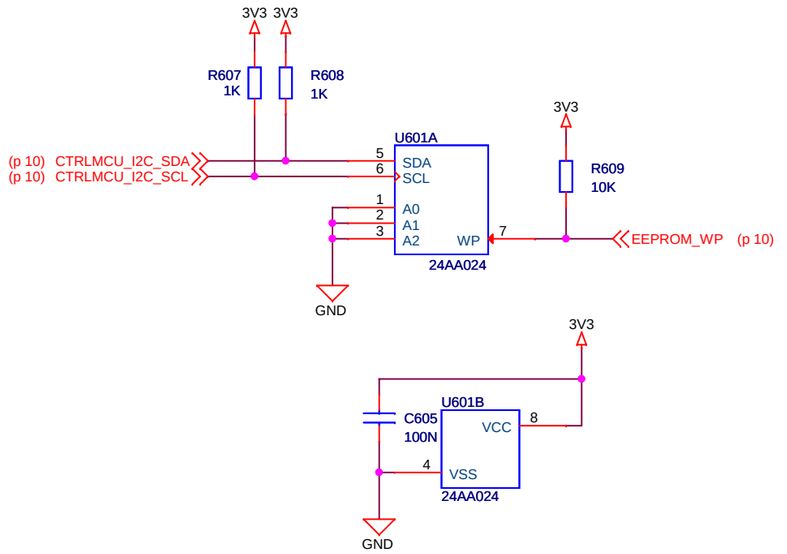

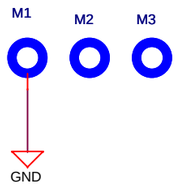

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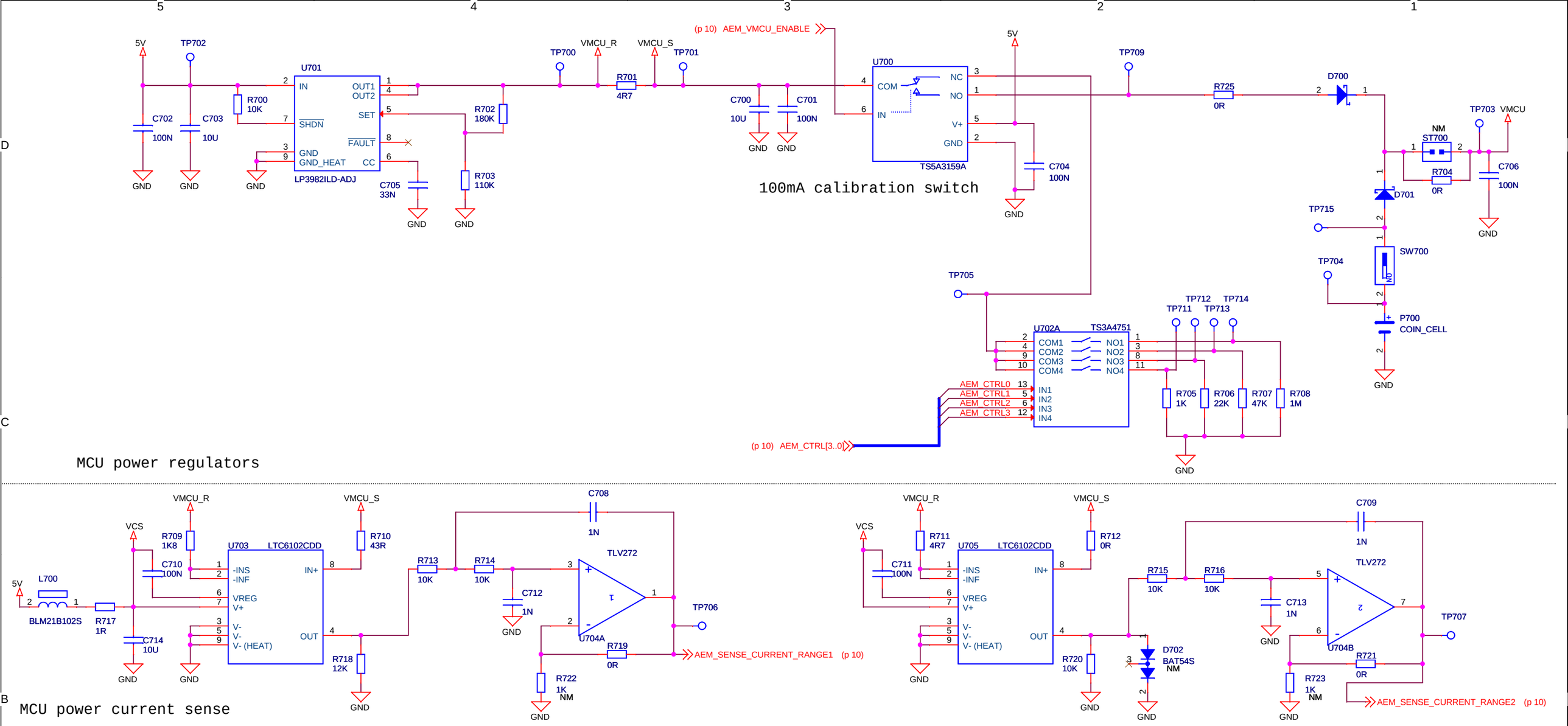

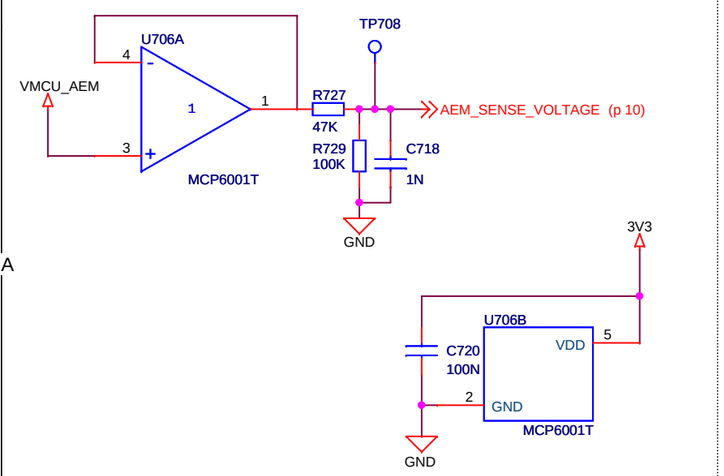

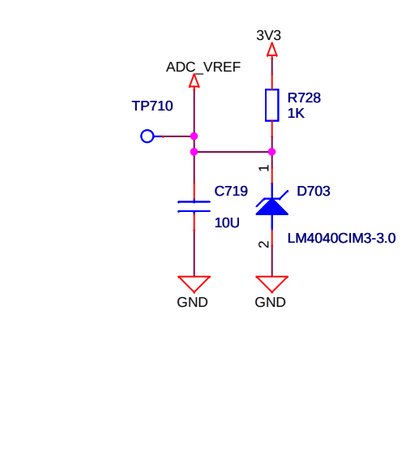

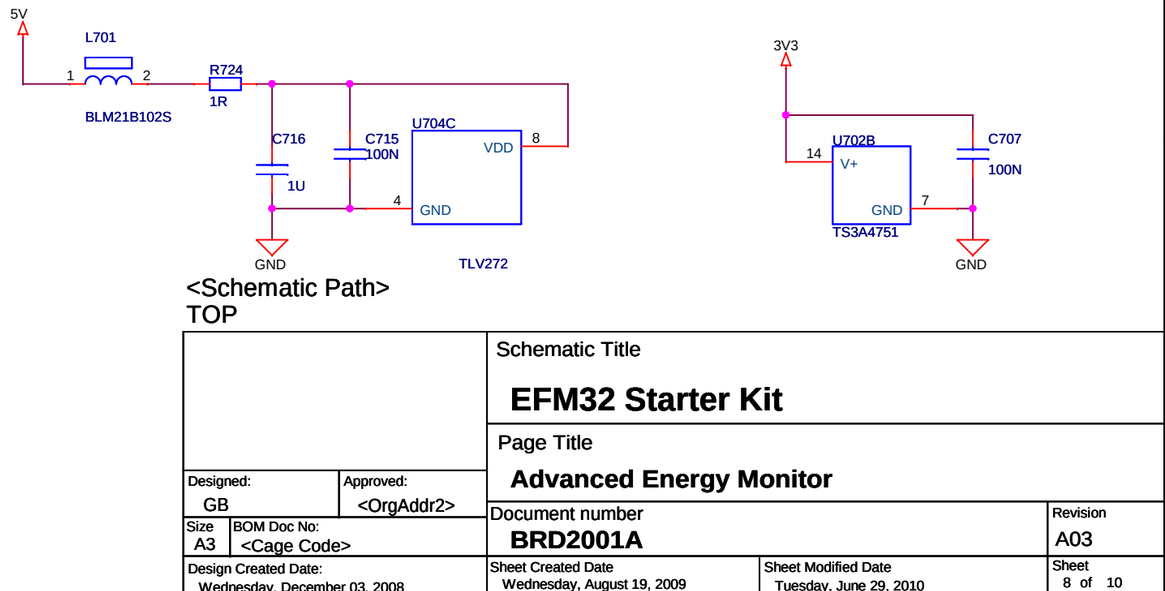

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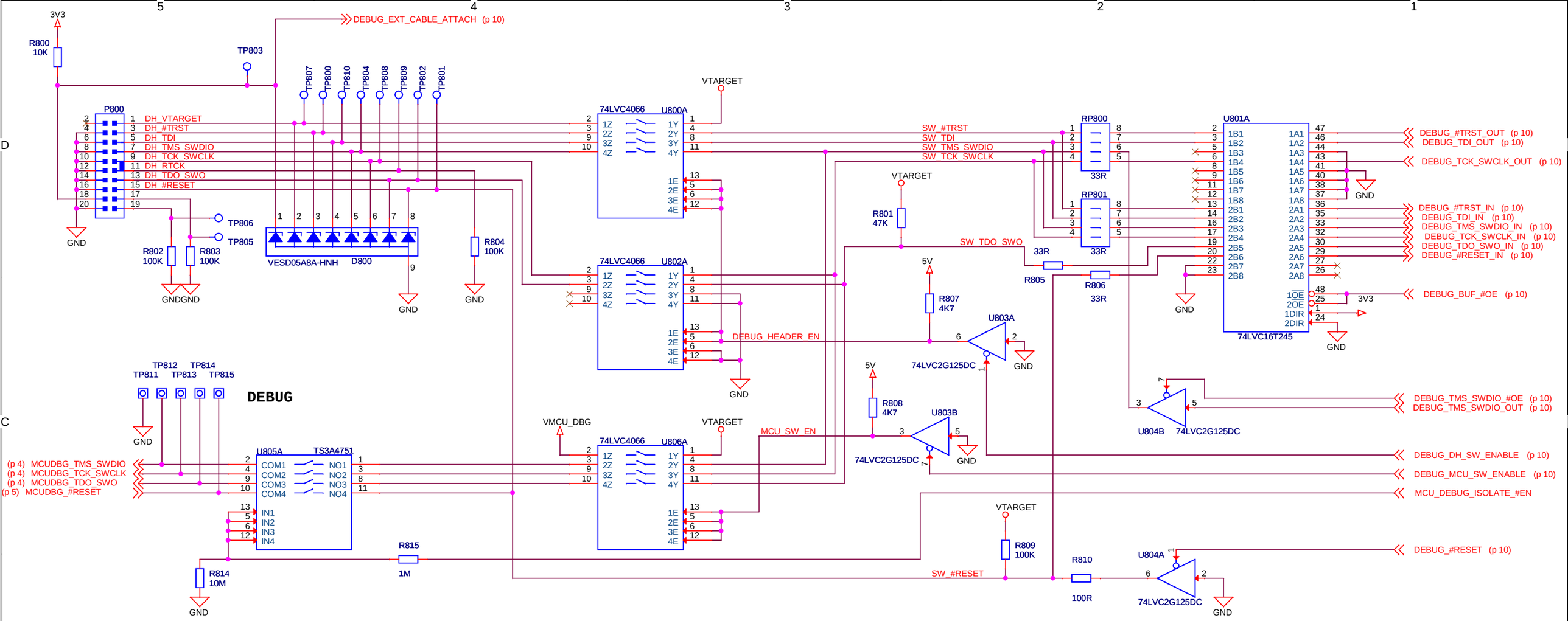
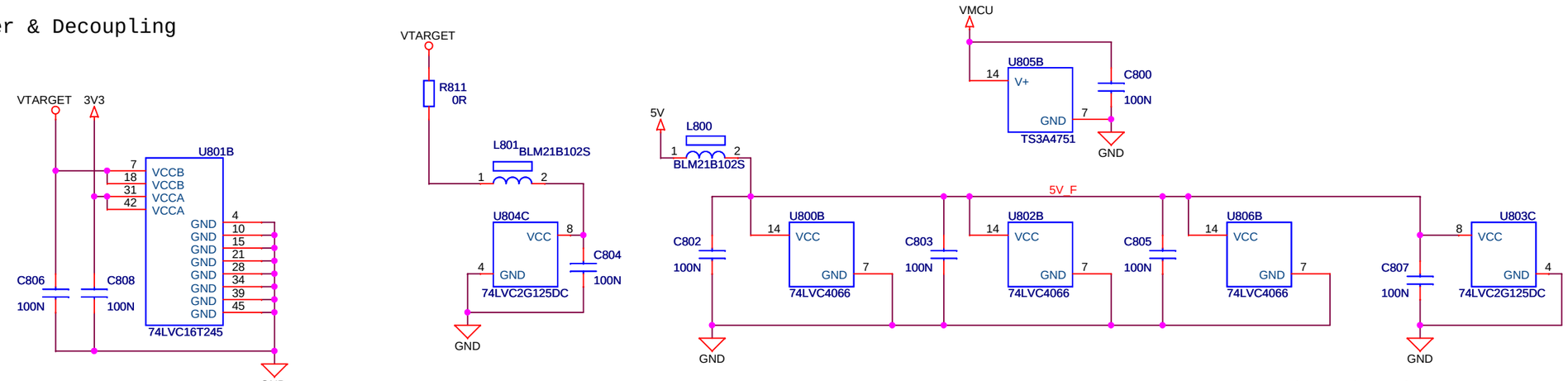


Power & Decoupling



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Debug Out	0	1	0	External voltage	External voltage
MCU Debug	1	0	0	Disconnected	VMCU
Debug In	1	1	1	VMCU	VMCU

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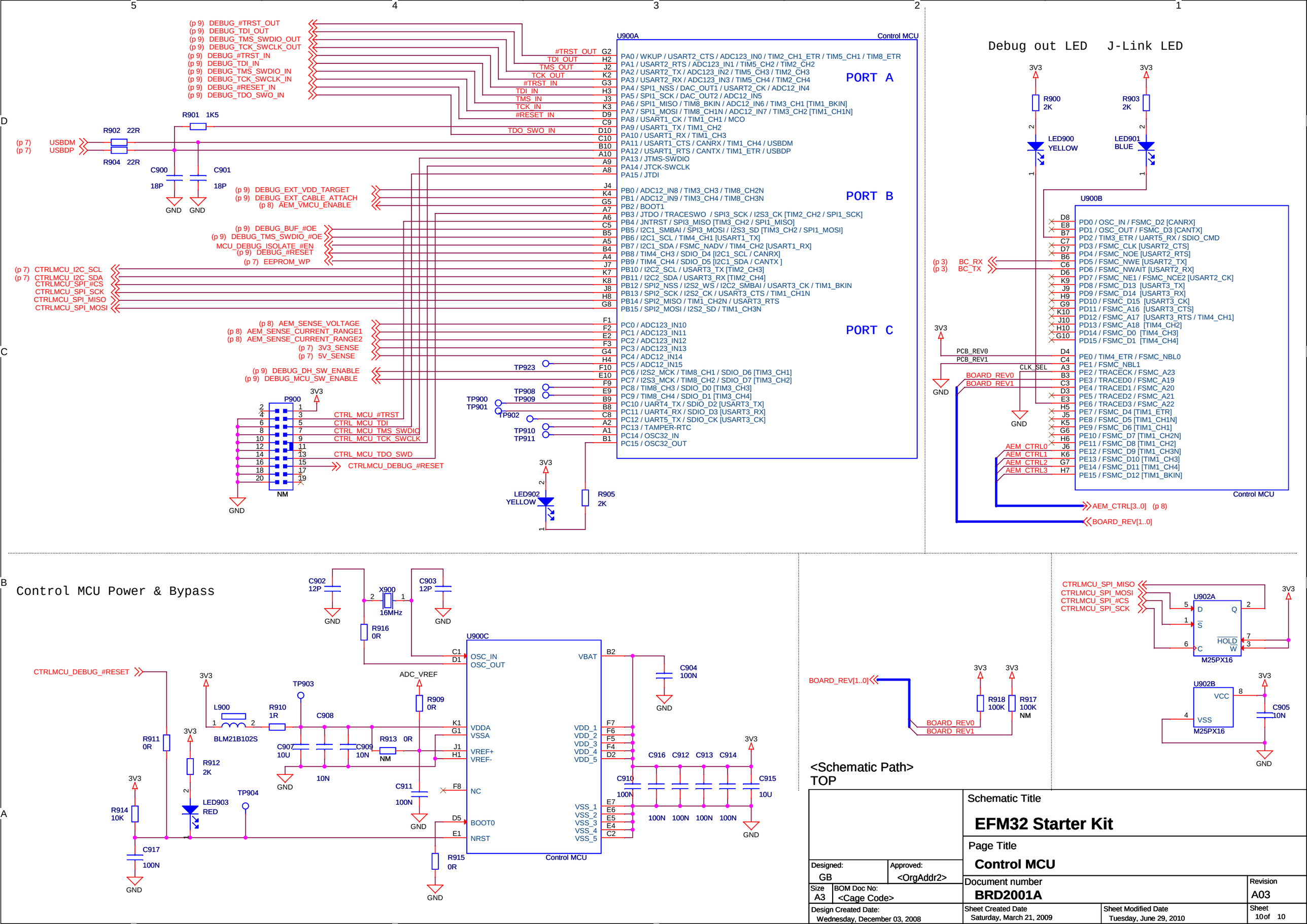

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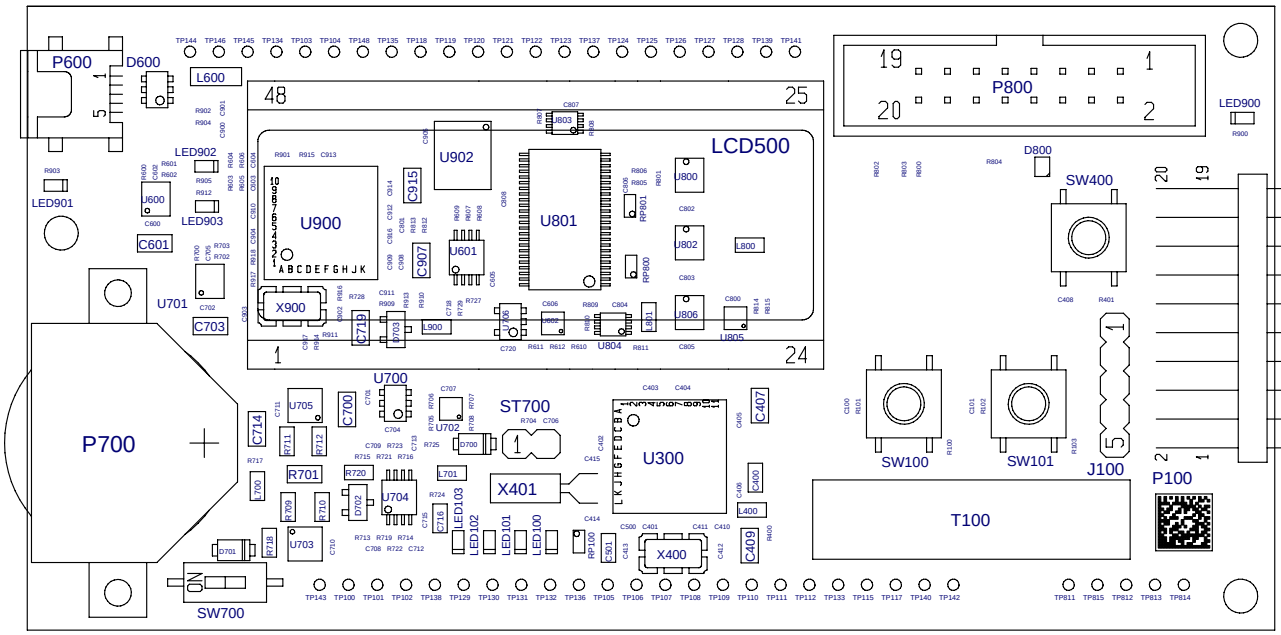

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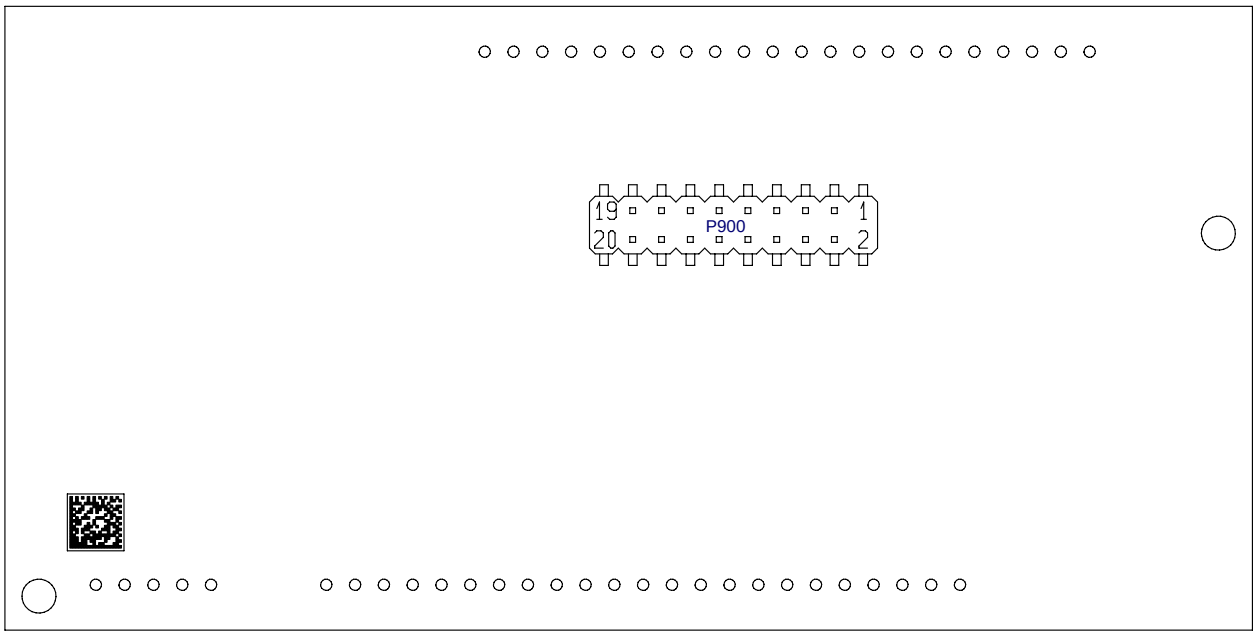
(Scale 1.5 : 1)	Dokumentnr - *Document No.* BRD2001A (PCB2001 REV. 2.0)		Side - *Sheet* 1 (2)



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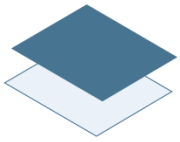

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